## Claims

## What is claimed is:

1. A plasma processing system comprising:

a plasma processing device having a first plasma density proximate a processing region and a second plasma density proximate an exit region;

an inter-stage plasma (ISP) source fluidly coupled to said plasma processing device proximate said exit region, said ISP source comprising an inter-stage plasma region having a third plasma density; and

a plasma pump fluidly coupled to said ISP, said plasma pump having a fourth plasma density, wherein pumping speed is dependent upon the third plasma density and the fourth plasma density.

- 2. The plasma processing system as claimed in claim 1, wherein said first plasma density is greater than said second plasma density.
- 3. The plasma processing system as claimed in claim 1, wherein said third plasma density is greater than said second plasma density.
- 4. The plasma processing system as claimed in claim 1, wherein said third plasma density is greater than said fourth plasma density.
- 5. The plasma processing system as claimed in claim 1, wherein said ISP comprises an inductively coupled plasma (ICP) source.
- 6. The plasma processing system as claimed in claim 1, wherein said ISP comprises a capacitively coupled plasma (CCP) source.
- 7. The plasma processing system as claimed in claim 1, wherein said ISP comprises a ring-shaped channel.

- 8. The plasma processing system as claimed in claim 1, wherein said ISP comprises a plurality of cylindrical channels arranged in a ring pattern.
- 9. The plasma processing system as claimed in claim 8, wherein said plasma pump comprises:

an annular conduit having an inlet end coupled to said ring-shaped channel, an outlet end, an interior wall, and an outer wall extending from the inlet end to the outlet end; and

magnet array, constructed and arranged to generate a magnetic field having field lines generally parallel to the outer wall.

- 10. The plasma processing system as claimed in claim 9, wherein said plasma pump comprises an electric field generator, constructed and arranged to generate a DC electric field having field lines generally parallel to the outer wall.
- 11. A method of operating a plasma processing system comprising: creating a plasma in a plasma processing device, said plasma having a first plasma density proximate a processing region and a second plasma density proximate an exit region;

moving a first number of particles from said exit region into an inter-stage plasma (ISP) source that is fluidly coupled to said plasma processing device proximate said exit region;

creating an inter-stage plasma having a third plasma density, said ISP source providing RF energy to said first number of particles in an inter-stage plasma region; and

pumping a second number of particles from said inter-stage plasma region to an exit region, wherein a plasma pump is fluidly coupled to said ISP, said plasma pump having a fourth plasma density, wherein pumping

speed is dependent upon the third plasma density and the fourth plasma density.